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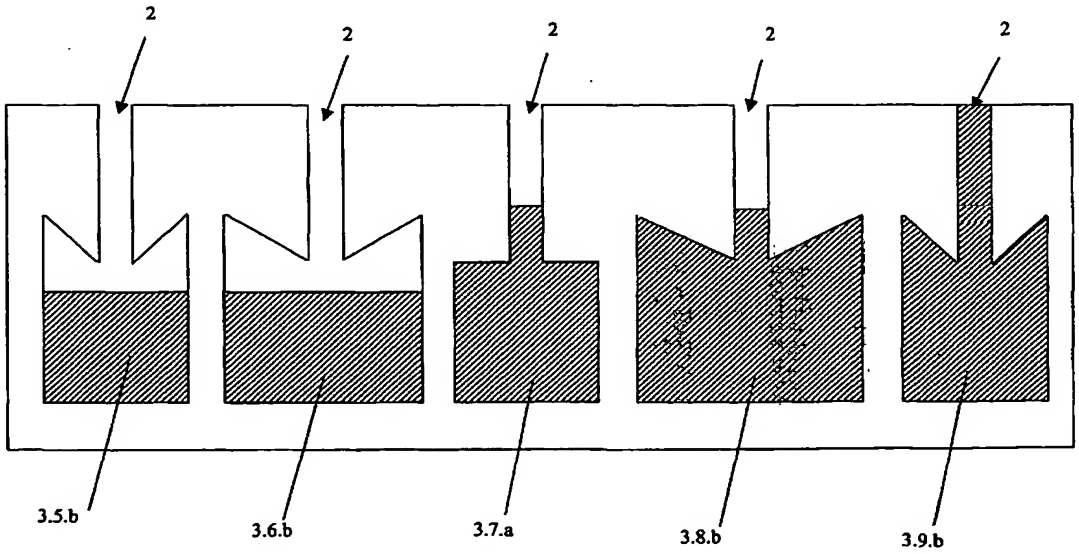
(54) Title: ACOUSTIC CONSTRUCTION ELEMENT



(57) Abstract: Acoustic construction element comprising sound insulating cavities having a constant shape along an axis parallel to the exposed surface of the construction element, at least part of said cavities comprising a first portion, situated closest to the external surface of the element, having a smaller width than the maximum width of a second, internal portion of the cavity, of which: - at least part of said cavities have different depths; - at least part of said cavities have different internal volumes and/or different internal shapes; - at least part of said cavities have a substantially constant width over their entire depth; - and at least part of said cavities are completely or partially filled with sound insulating material.

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ACOUSTIC CONSTRUCTION ELEMENT

The present invention relates to an acoustic construction element comprising sound insulating cavities.

Numerous variants of this type of acoustic construction elements have been proposed in the art in order to provide a more or less satisfactory balance of the acoustic properties and the cost of production.
Many of these attempts are disclodes in the patent literature.

In European patent application n° EP 0 580 096, for example, there is described a sound-insulation element having a wall exhibiting perforations, and having a cavity which receives a sound-absorbing packing, which covers the mounths of the perforations.
The acoustic bricks usually consist of ceramic material.

In French patent application n° FR 2612225, there is revealed an acoustic lining element, made of burnt clay, ceramic materials, cement, wood, plaster or the like. This acoustic lining element comprises a plane rectangular face intended to be attached to a wall. The opposite face to this one comprises a network of ribs forming corrugations parallel to one of the sides.

Japanes patent application n° JP 09328833 describes a sound-absorbing block, obtained by baking fire clay, into which a pore imparting material is mixed, and fire-resisting chamotte. In the ceramic block, there are bored

holes of different depth, drilled all over at right angles to the thickness direction. The ceramic block is reported to have sound absorbing performance in a frequency band having broad width.

In German patent application DE 198 23 139, there is described an acoustic element comprising sound insulating cavities having a constant shape along an axis parallel to the exposed surface of the construction element, at least part of said cavities comprising a first portion, situated closest to the external surface of the element, having a smaller width than the maximum width of a second, internal portion of the cavity.

German patent application DE 33 22 189 and French patent publication FR 2 746 831 describe construction elements comprising cavities with different shapes and sizes.

DE 197 41 282 disclose acoustic construction elements showing several subsequent layers of zones of different structure and/or nature, whereas part of said zones consist of ceramic foam.

Each of the individual solutions thus proposed in the art to improve the properties of acoustic construction elements have shown to be satisfactory to a very limited extend.
Combining those various solutions would of course appear as a further way forward but it has shown that several of the proposed solutions are mutually excluding or give rise to practical technical problems.

The purpose of this invention is to combine, in a very specific way, some of the proposed features with other added features so as to provide an acoustic construction element having optimal properties.

The invention thus provides a sound insulating construction element that can absorb a broad range of sound frequencies and that can be manufactured depending on the type or the frequency of noise pressure.
For instance, the frequency of the disturbing noise that results from a truck that drives on a highway differs from the noise that has to be absorbed when one records a song in a music studio.

This object of the invention is achieved by an acoustic construction element with sound insulating cavities having a constant shape along an axis parallel to the exposed surface of the construction element, at least part of said cavities comprising a first portion, situated closest to the external surface of the element and with a smaller width than the maximum width of a second, internal portion of the cavity, said acoustic elements further comprising sound insulating cavities with:

- at least part of said cavities have different depths;
- at least part of said cavities have different internal volumes and/or different internal shapes;

- at least part of said cavities have a substantially constant width over their entire depth;
- and at least part of said cavities are completely or partially filled with sound insulating material.

According to a first preferred feature of the invention, the cavities have an angular shape.
The intention of this is to provide a volume as large as possible after the entry.

According to a further preferred feature of the invention, the cavities have a pseudo-rectangular shape. So, there is more reflection of the sound inside the cavity.

Pseudo-rectangular means that the cavities have at least one acute angle.

In a first embodiment, at least 90 % of the cavities are completely filled with sound insulating material.

In a second embodiment according to the invention, at least 90 % of the cavities are partially filled with sound insulating material.

In a preferred embodiment of the invention, the cavities are completely or partially filled with foamed mineral product.

Depending on the circumstances when the cavities of an acoustic element are completely or partially filled with such material, the absorption of the sound is much better.

In another preferred embodiment according to the invention, the cavities are completely or partially filled with foamed clay, glass and pearlite.

In a first method for manufacturing acoustic construction elements according to the invention, the elements are manufactured in one step process.

Such method is used where the sound isolating material has a bake curve corresponding to the material from which the acoustic construction elements are made.

A second method for manufacturing acoustic construction elements is to manufacture the elements in a two process step.

In a two process step, the sound isolating material, for example : polystyrene foam (such as isomo®), glass wool,... is introduced in the cavities in a second process step. This method is of course also applicable for material which has a bake curve corresponding to the material from which the acoustic construction elements are made.

Preferably, said construction element is made of ceramic material. In this way, ceramic construction elements can

be used as regular building bricks. The construction element according to the invention can also be used as a trafic load carrying construction element.

The method for manufacturing acoustic construction elements is preferably by way of extrusion of the ceramic materials.

Further distinctive features and characteristics will be clarified in the following description of a specific embodiment of the invention as represented in the attached drawings. It should be noted that this embodiment is only given by way of example and implies no restriction in the general scope of the invention as that appears from the above description and from the claims at the end of this text.

In the attached drawings:

- figure 1 is a cross section of an acoustic construction element;
- figure 2 is a cross section of an acoustic construction element of wich the cavities have an angular shape;
- figure 3 is a cross section of an acoustic construction element of wich the cavities have an angular or pseudo-rectangular shape.

As shown in figure 1, the acoustic construction element is an acoustic brick (1) with a length of 324 cm., a heigth of 5 cm. and a width of 10 cm.. The brick is manufactured by extrusion of ceramic material, more specific red-baking clay. The acoustic brick has a smooth

surface. By using other clays or by addition of aggregates to the base material, the brick can obtain a different color or even a sandy structure. The surface can also be rough. In function of the composition, characteristics as the absorption of water, the intensity of the pressure, etc can differ.

As shown in figures 1, 2 and 3, the acoustic brick (1) comprises at irregular distances, separate entries (2) of cavities (3), the cavities in general are designated by reference numerals 3. etc., which:

- have different depths, this difference is shown in figure 1, where one notices that cavity (3.11.a) is deeper than cavity (3.10.a);
- have different internal volumes and/or different shapes, there are cavities which have an angular shape (3.1.a, 3.2.a, 3.3.a, 3.4.a, 3.7.a) and cavities with an pseudo-rectangular shape (3.5.b, 3.6.b, 3.8.b, 3.9.b).
  The purpose behind this is to obtain a volume as large as possible after the entry of the cavitie (3);
- have a substantially constant width over their entire depth;
- are completely or partially filled with sound insulating material, according to the figures 1,2 and 3, all the cavities in figure 1 are completely filled, in figure 2 and 3, are 3.1a, 3.2a, 3.3a 3.5b, 3.6b, 3.7a and 3.8b partially

filled. The other cavities 3.4a and 3.9b are completely filled.

A possible sound insulating material is ceramic foam. Ceramic foam is a verry porous material with a verry low coefficient of heat conduction.

The brick has thus a two-fold function: for one, the ceramic mass takes care for the absorption of the sound - the ceramic mass is the combination of the brick and the sound absorbing material -, And for another, the cavities, partially or completely filled with sound insulating material, are dimensioned in such a way that through the way of internal reflection, the sound doesn't get the chance to be reflected into free space.

In this way, the depth, the shape and the internal volume of the cavities (3) and their position on the stone can be adapte in function of certain types of frequencies and/or the level of the sound that has to be adsorbed.

An other object of the invention is the method of manufacturing an acoustic construction element comprising sound insulating cavities.

A first method is to manufacture a brick in one process step. Hereby, the brick is extruded of ceramic material and is provided with a cavity (3).

After the drying of the formed stone, the sound insulting material is introduced through the entry (2) of the cavity (3). This combination (brick+sound insulating material) is brought into a heating device where during one process step baking as well as expansion of the sound insulating material happend.

Use of this method is only possible if the sound insulating material has a bake curve corresponding to the material from which the acoustic construction elements are made.

Another method for manufacturing a construction element according to the invention is to fabricate a brick in a two process step.
Hereby, the sound insulating materials, for example glass wool, foamed plastic (such as isomo®),... are introduced in a second process step, after the drying and baking of the brick.

The acoustic construction element according to the invention can be used in every place where noise or noise pollution is an item, for instance in:

- laboratory
- hospitals
- industry
  - as an inside or outside wall of factories, offices,...
  - around compressors, motors, machines and computer rooms
- concert halls, theatres, disco's, exposition halls, cinema rooms, hotel and catering industry,...
- along motorways, highways, train sections, stations, airports,...
- as a parition wall in apartment buildings and office buildings: aroun elevator shafts, engine rooms,...
- municipal buildings: libraries, sport halls, cultural centers,

- school and universities
- agriculture and cattle breeding: pig farms, chicken coops,...

In certain applications, the cavities can also serve as a carrier of technical pipes for, for instance, electricity, computers, telephone, sanitary, heating, ...

The bricks or the panels can be mounted either horizontally, either vertically, or in a combination of the two, can be glued together or layed in bricks, or can function as a carrying or non-carrying part. For example, the bricks can be used as road blocks on which traffic can circulate. The disturbing frequencies that arise when car types roll over the road surface can be absorbed by using the acoustic bricks as horizontal carrying driving surfaces. The cavities that are present in the bricks could also function for draining the excess of water when it's raining.

C L A I M S

1.Acoustic construction element comprising sound insulating cavities having a constant shape along an axis parallel to the exposed surface of the construction element, at least part of said cavities comprising a first portion, situated closest to the external surface of the element, having a smaller width than the maximum width of a second, internal portion of the cavity, **characterised in that**

at least part of said cavities have different depths;

at least part of said cavities have different internal volumes and/or different internal shapes;

at least part of said cavities have a substantially constant width over their entire depth;

and at least part of said cavities are completely or partially filled with sound insulating material.

2.Acoustic construction element according to claim 1, **characterised in that** the cavities have an angular shape.

3.Acoustic construction element according to claim 1, **characterised in that** the cavities have a pseudo-rectangular shape.

4.Acoustic construction element according to claims 1 to 3, **characterised in that** at least 90 % of said cavities are completely filled with sound insulating material.

5.Acoustic construction element according to claims 1 to 3, **characterised in that** at least 90 % of said cavities are partially filled with sound insulating material.

6.Acoustic construction element according to any one of claims 1 to 5, **characterised in that** said cavities are completely or partially filled with a foamed mineral product.

7.Acoustic construction element according to any one of claims 1 to 5, **characterised in that** said cavities are completely or partially filled with foamed clay, glass or pearlite.

8.Method for manufacturing acoustic construction elements according to claims 1 to 7, **characterised in that** said elements are manufactured in one step process, whereas the sound isolating material has a bake curve corresponding to the material from which the acoustic construction elements are made.

9.Method for manufacturing acoustic construction elements according to claims 1 to 8, **characterised in that** said elements are manufactured in a two process step, whereas the sound isolating material is introduced in the cavities in a second process step.

10.Use of an acoustic construction element according to claim 1, **characterised in that** said construction element is used as a trafic load carrying construction element.

11.Use of an acoustic construction element according to claims 1 to 7 , **characterised in that** an acoustic element according to claims 4 to 7 is used.

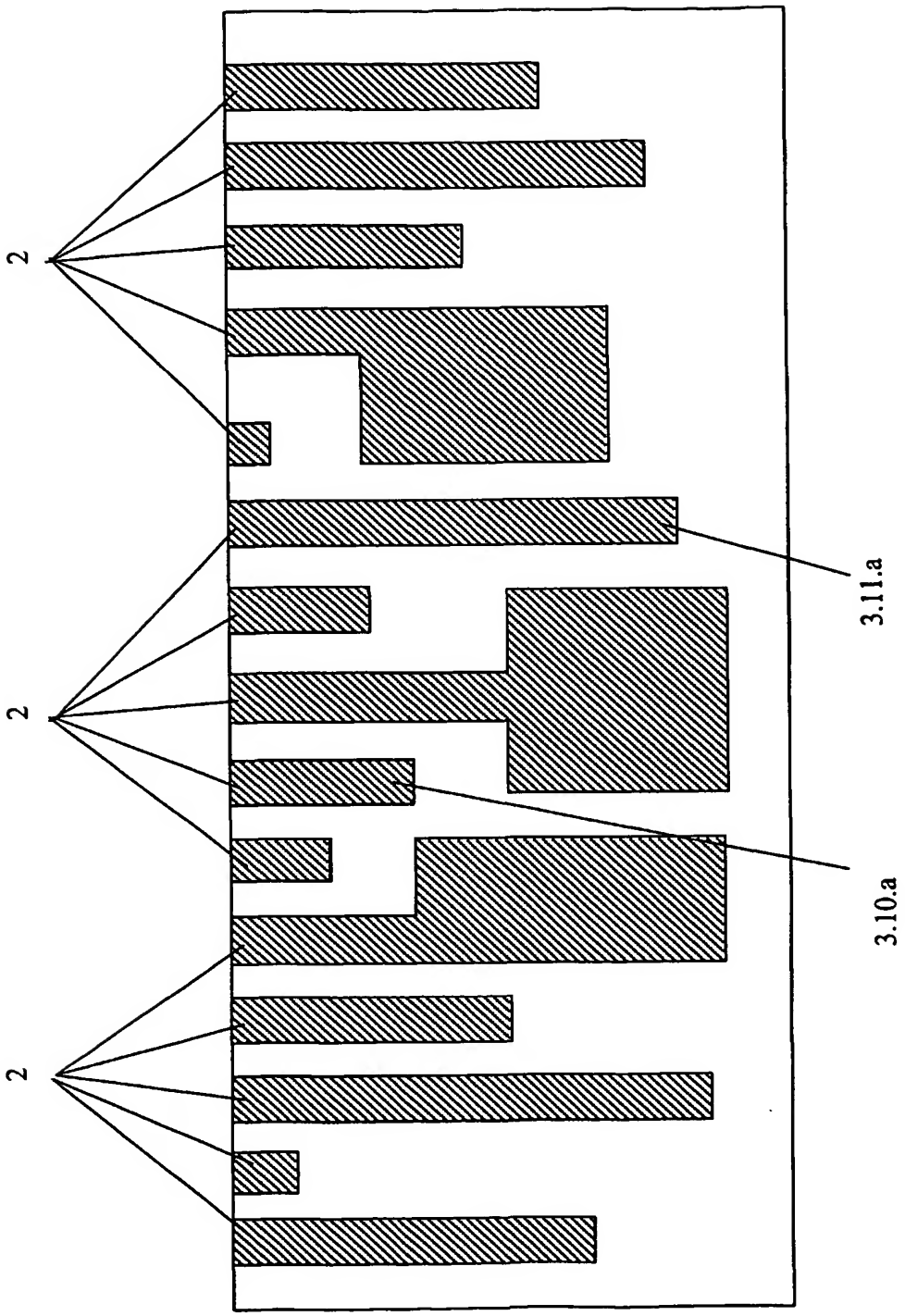

Fig. 1

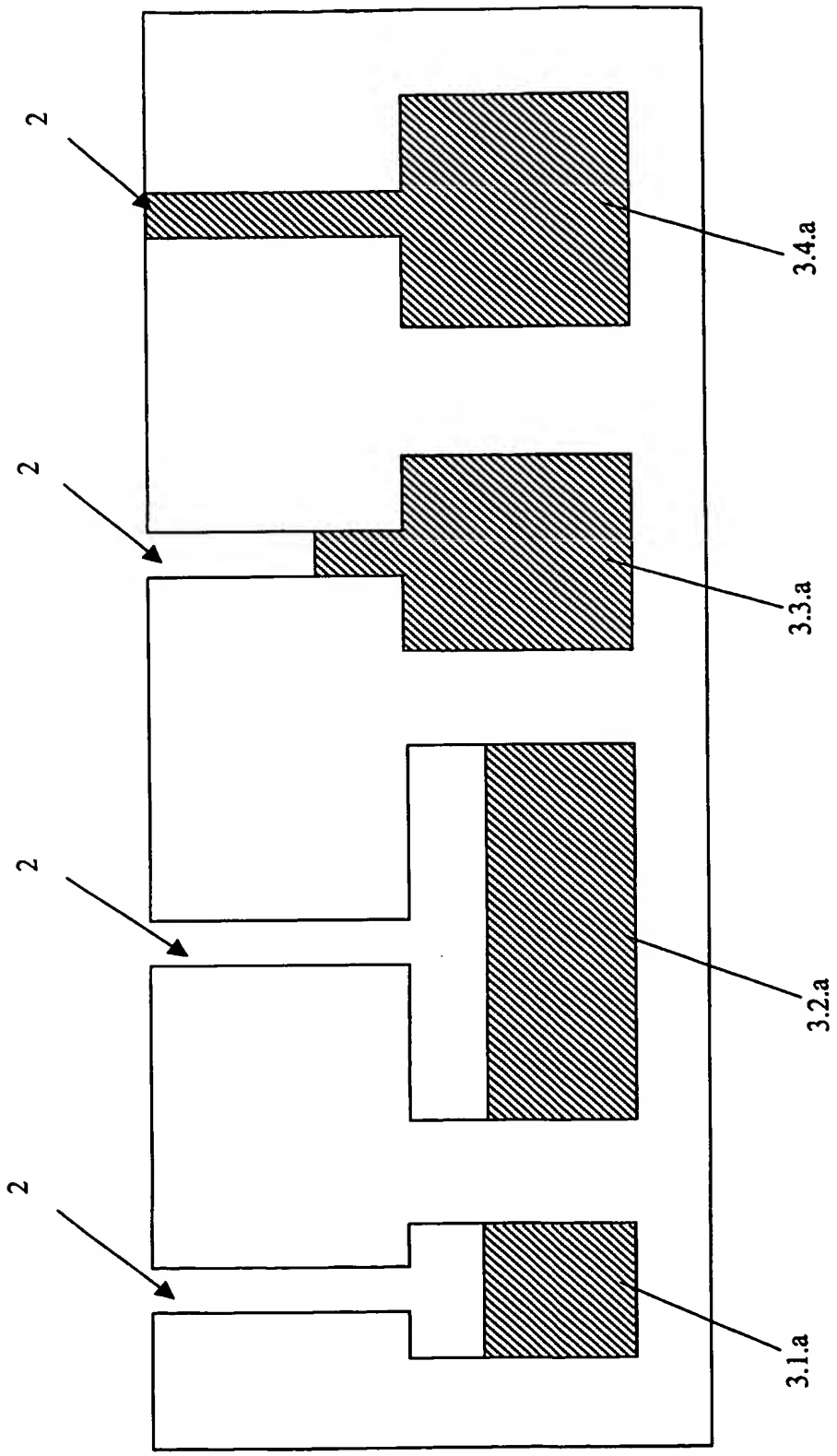

Fig. 2

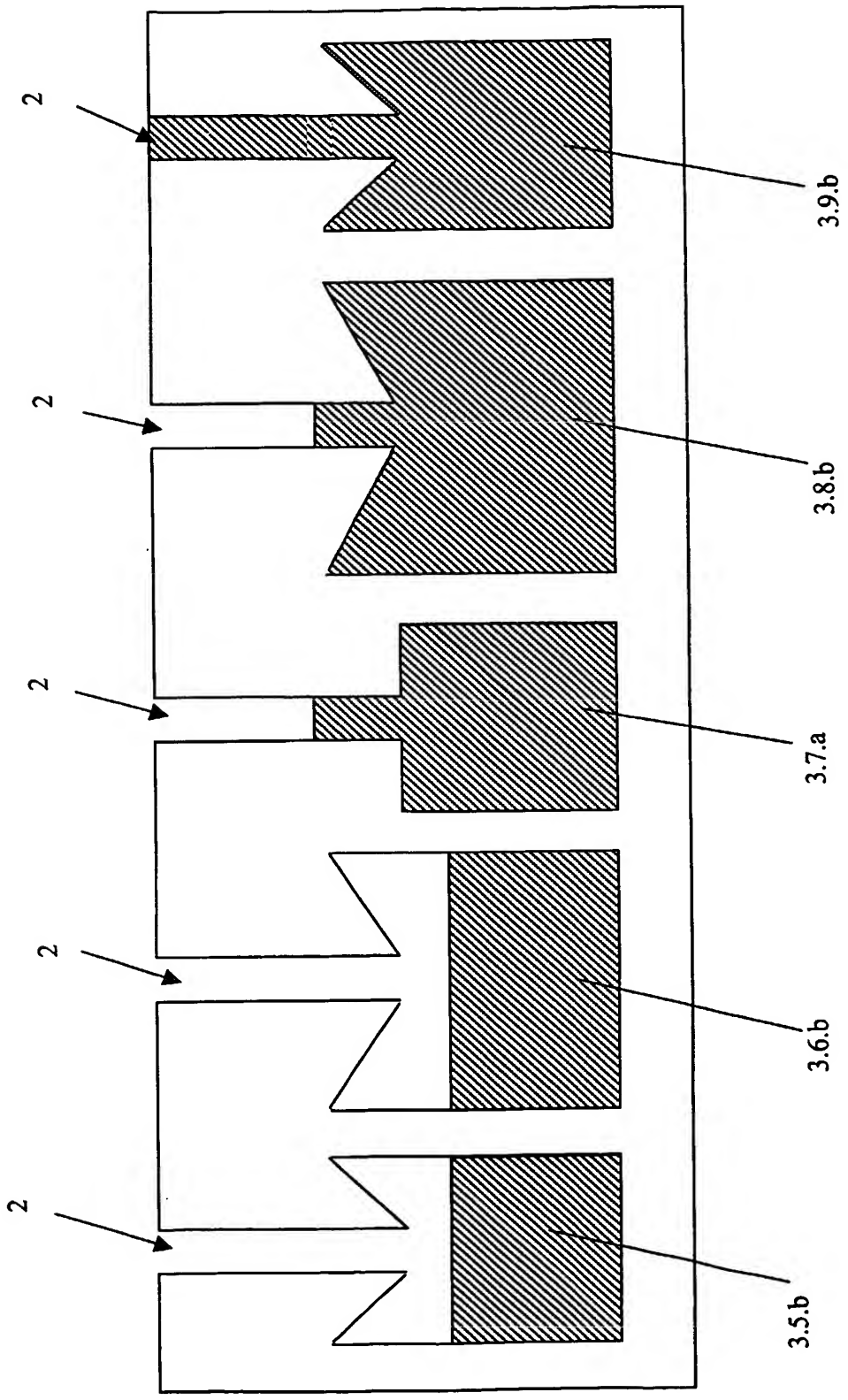

Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04B1/84 E01F8/00 B28B3/20 B28B3/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E04B E01F B28B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15 November 2002	25/11/2002

Name and mailing address of the ISA	Authorized officer
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International Application No
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